Blended Wing Body
A Green Future Air Transportation Concept

Volker Gollnick, Pier Davide Ciampa

German Aerospace Center

Air Transportation Systems

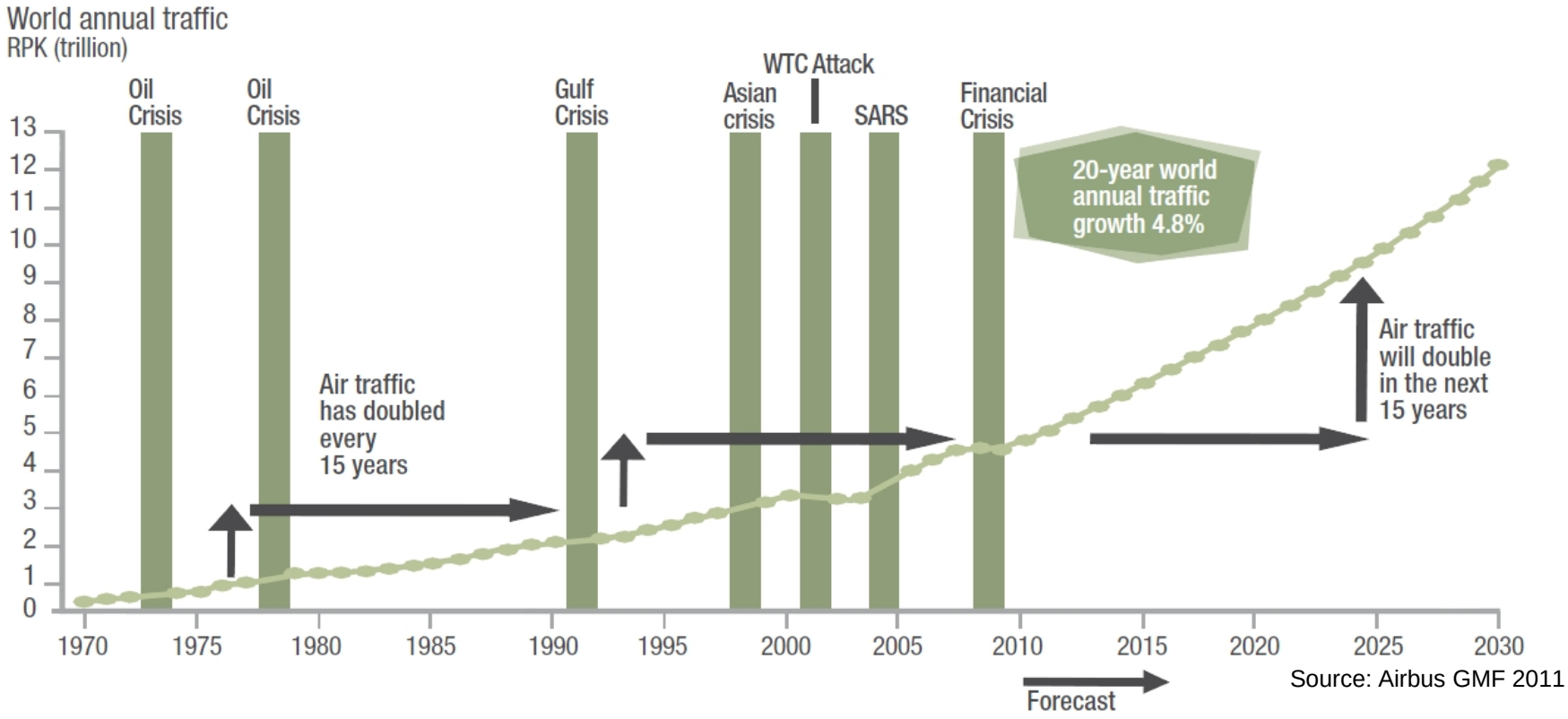
Greener Skies Ahead
13th September 2012
Berlin

Outline

- Boundaries for Future Developments
- Trade Off between Mobility and Green Transportation
- BWB @ DLR: An Integrated Approach
- BWB concept assessment
- Conclusion

Boundaries for Future Developments

Perspectives in Aviation (1/3)

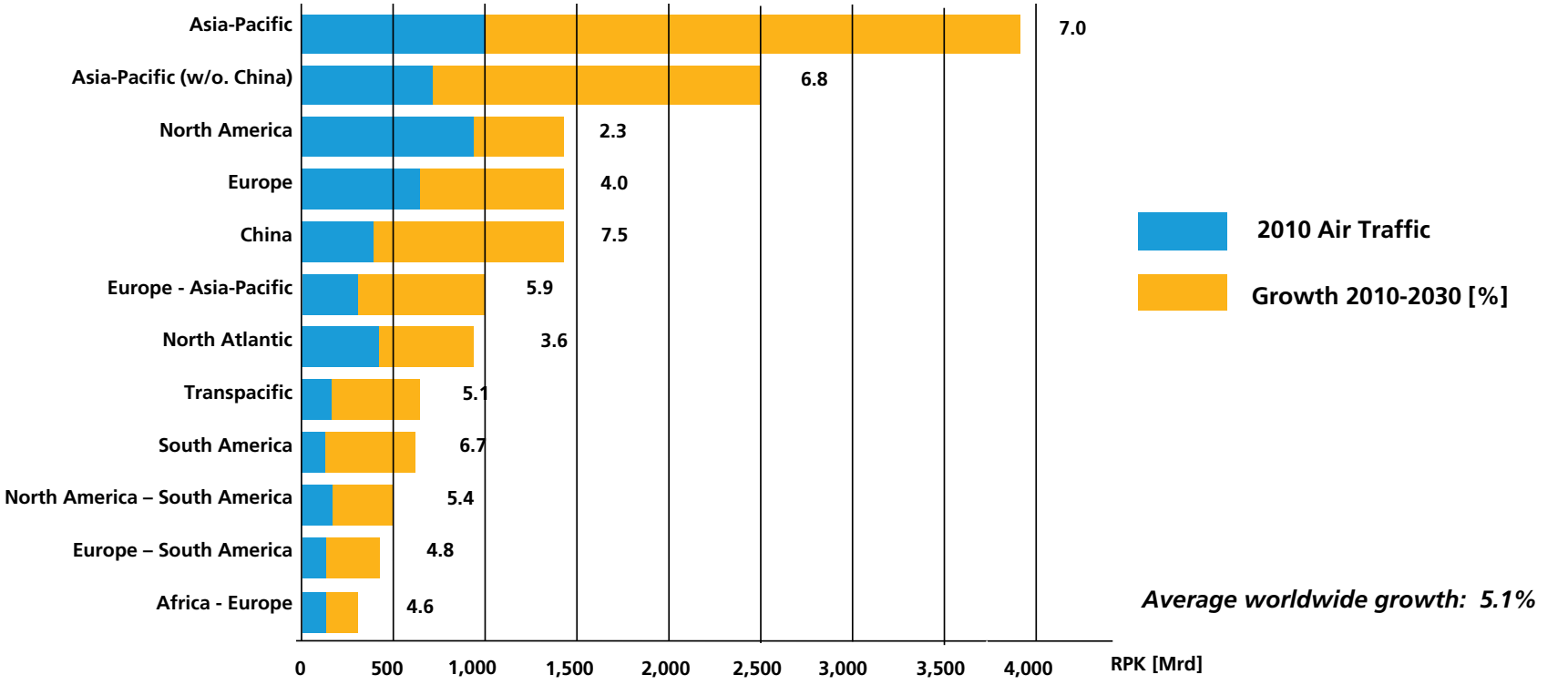


Source: Airbus GMF 2011

➔ Despite any disturbancies aviation industry is still expecting **4.8% global annual growth** in terms of growing passenger movements

Boundaries for Future Developments

Perspectives in Aviation (2/3)



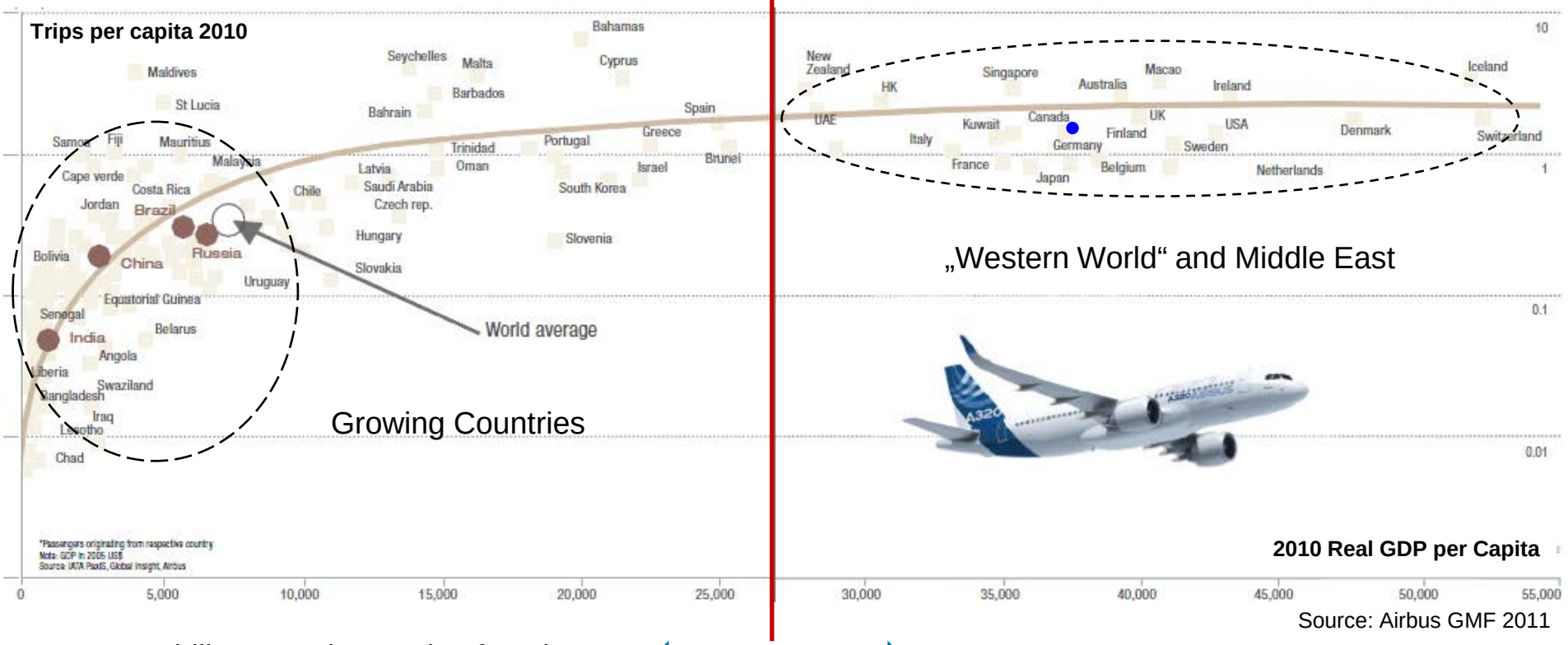
Source: Boeing Market Qutlook 2011

➔ Remarkable growth on long range

➔ Growth on short range is depending on regions

Boundaries for Future Developments

Perspectives in Aviation (3/3)



Source: Airbus GMF 2011

Mobility steep increasing function of the economic growth

Mobility nearly independent from economic growth and static

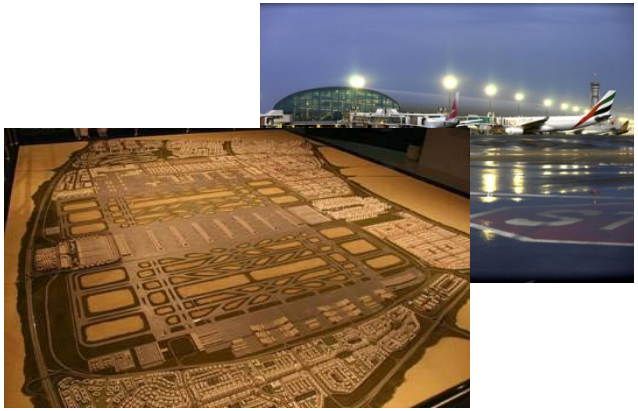
➔ Short range transport will increase in growing countries with own manufacturing industry

➔ Long range transport will grow between „Western World, Middle East and Growing Countries

Boundaries for Future Developments

Changing Global Air Traffic Flow

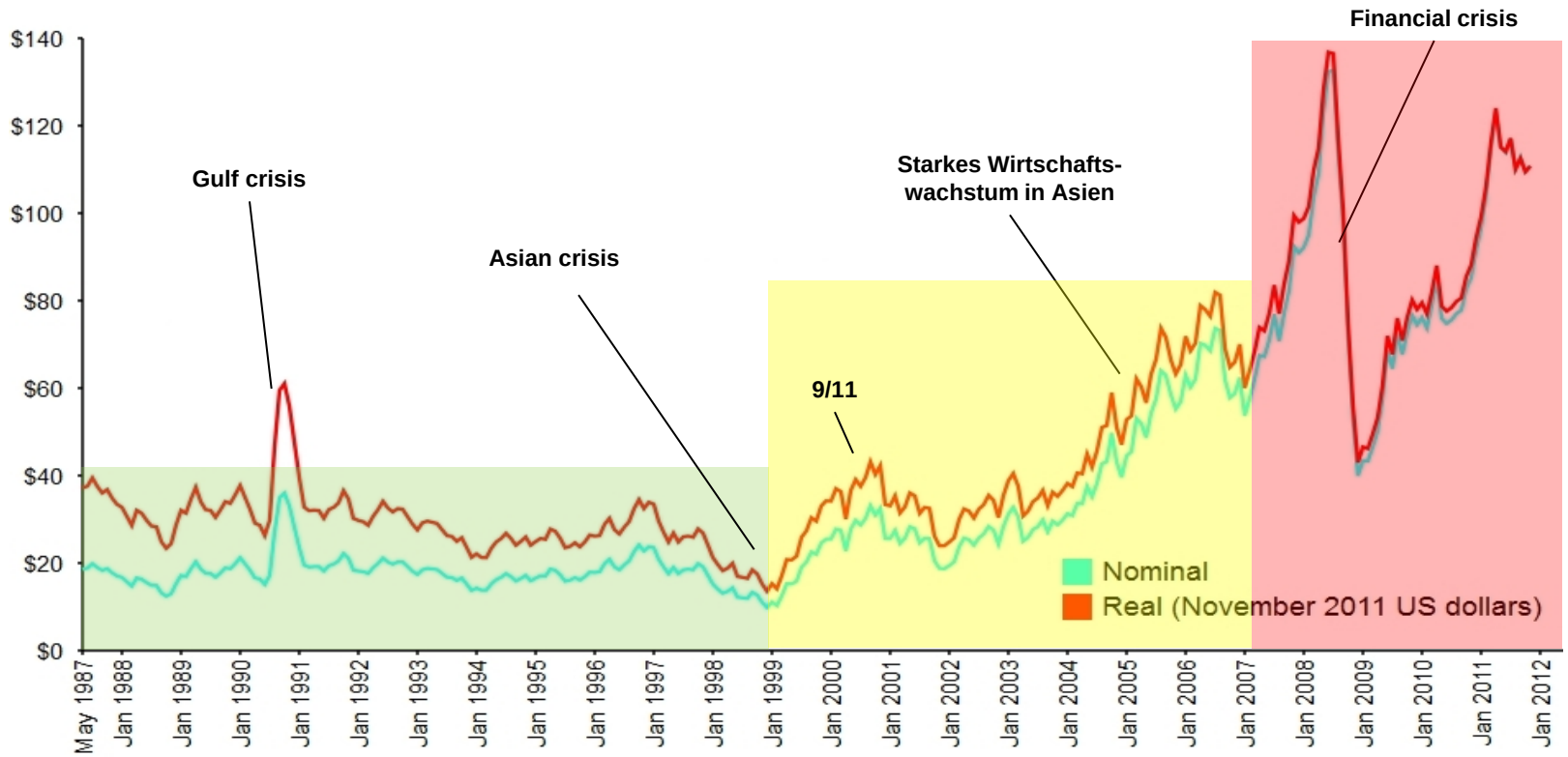
- **Middle East reaches 2/3 of global population** within 8 hours flight
- **Mega airport turntables** provide significant long range transport capacities
- **Air transport flows will change** resulting in a changing relevance of the acutal airport hubs and spokes in Europe
- **European Airlines will benefit but also change** their business models due to the Middle East and Asian developments



Dubai World Central Airport

Boundaries for Future Developments

Oil Price Development 1987 - 2012



➔ Oil price is constantly growing with increasing gradient, which leads to a highly sensitive and destabilizing development

Source: EIA

Trade Off between Mobility and Green Transportation

- **Mobility is a major pillar** of high life style and prosperity
- Increasing energy/oil cost and ecological responsibility **argue against quantitative traffic growth**
- Ensure **mobility with less energy effort**, materials, emissions and noise **requests for less traffic ➔ less aircraft, less airport, airspace capacity**
- **Passenger mobility** can be achieved with **less aircraft movements**
- **Cost and emissions** per flight are **to be shared** by more people per trip

➔ Paradigm shift from quantitative air transport growth to qualitative air transport growth

Source: U. Becker, TU Dresden, V. Gollnick, DLR

The Paradigm Shift of Flying

Qualitative Growth of Aviation

- Balance of time, cost, emissions, effort
  - **Less traffic, less aircraft, consolidated capacities**
  - **Less** noise and **emissions**
  - **More** potential for robustness, and reliability in the transportation processes

- **Increased level of service**
  - **More comfort** and relaxed **travel experience**
  - Air transport is **more attractive**
  - **More** potential for **punctuality** (door to door)

- **Common Vision**
  - Joint targets and common goals

- **Integrated ATS**
  - Understanding of systems dependencies

Source: U. Becker, TU Dresden, V. Gollnick, DLR

DLR

The Blended Wing Body

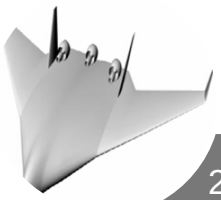
A potential solution

- It offers potential benefits
- Expand the design space and possibilities
- It gives answers to global developments
- „Known unconventional“!
- It is emotional!
- Still technically challenging

2040: DLR BWB

2012: NASA X-48C

2007: SAX-40



2004: MOB

1989: B2

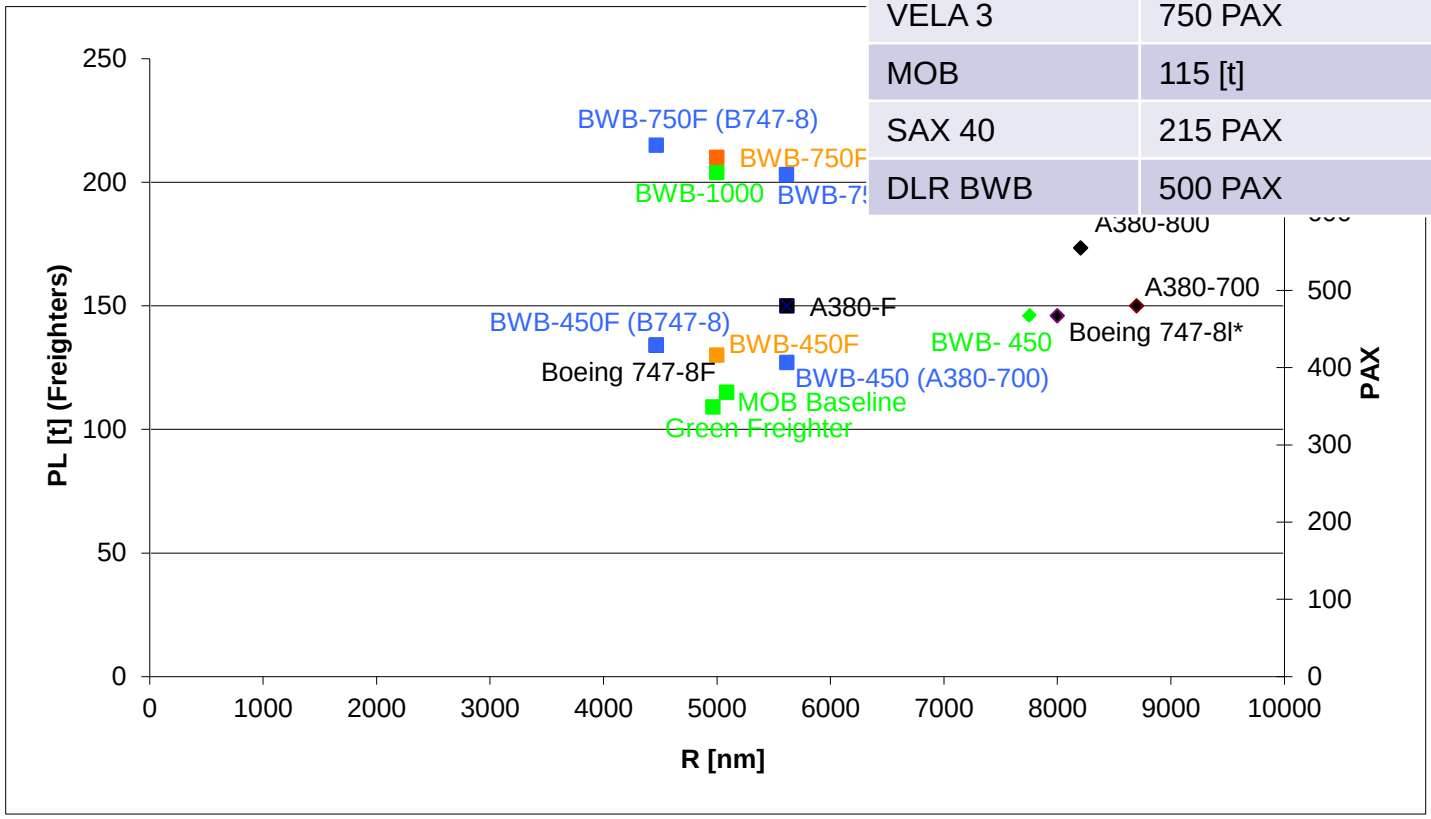
1945: Horten IX V2

DLR

The Blended Wing Body

A potential solution

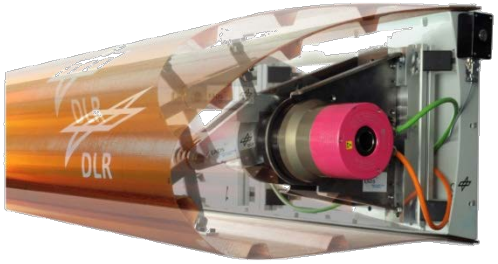
Concepts	Payload - Cabin	Range [nm]	Mach
BWB 450	468 PAX	7750	0.85
VELA 3	750 PAX	7650	0.85
MOB	115 [t]	5087	0.85
SAX 40	215 PAX	5000	0.8
DLR BWB	500 PAX	7750	0.85



DLR Integrated Design Approach

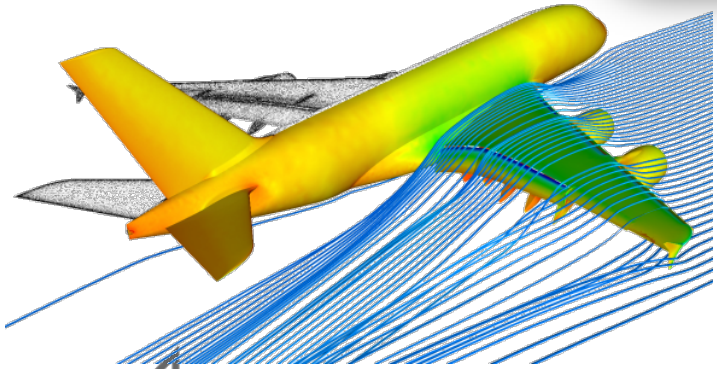
Design for ATS

Airport



Vehicle

Technologies

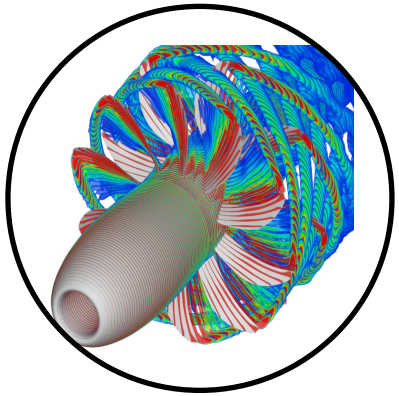


Operations

DLR

DLR BWB

A Coupled Disciplinary Design



- Concept
- Benefit
- Challenge
- MDO
- Integration

Source: DLR, Institute for Air Transportation Systems

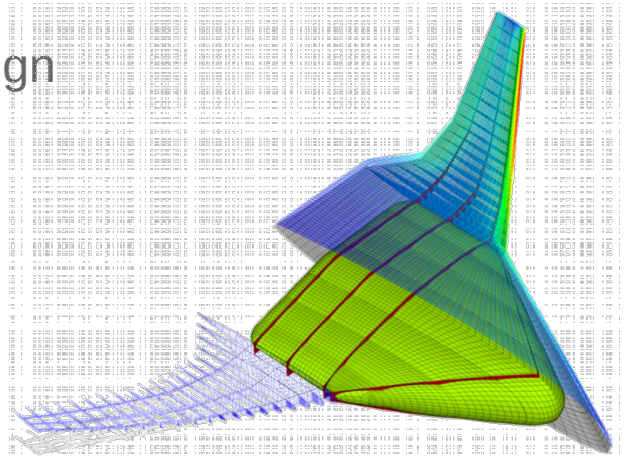
DLR BWB

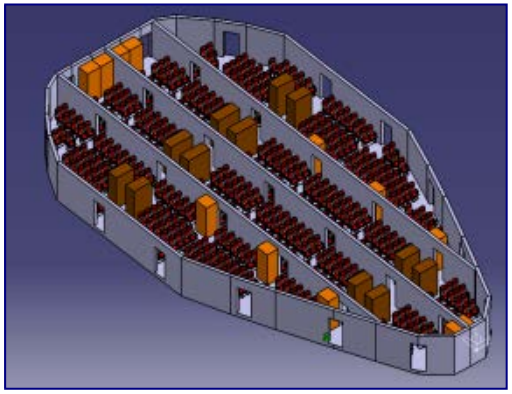
An Overall ATS Design

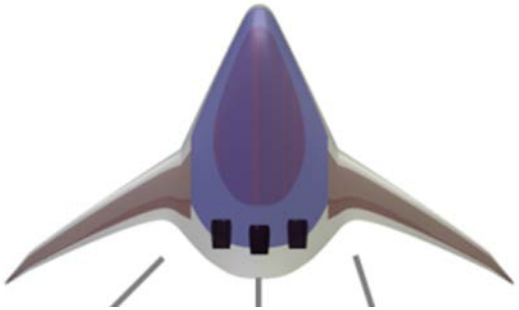
Cabin Design

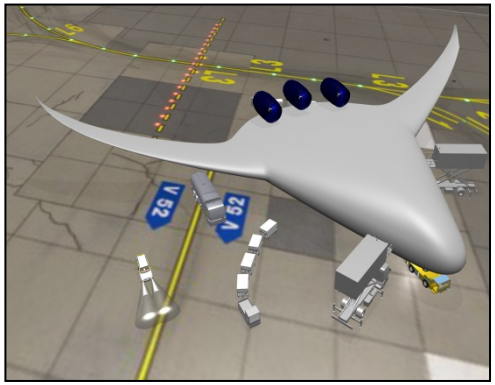
Boarding

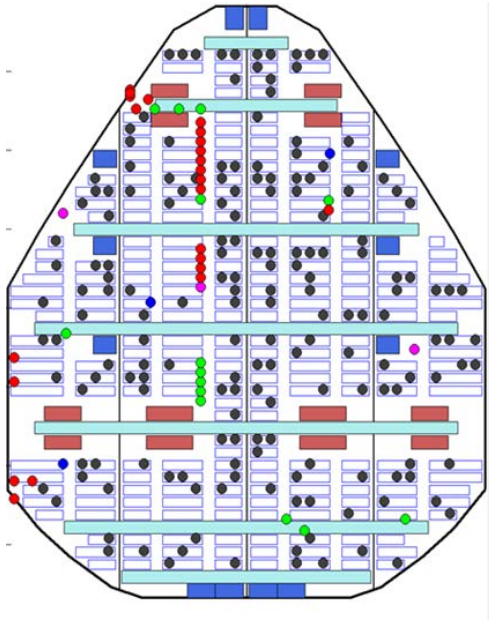
Turnaround Operations









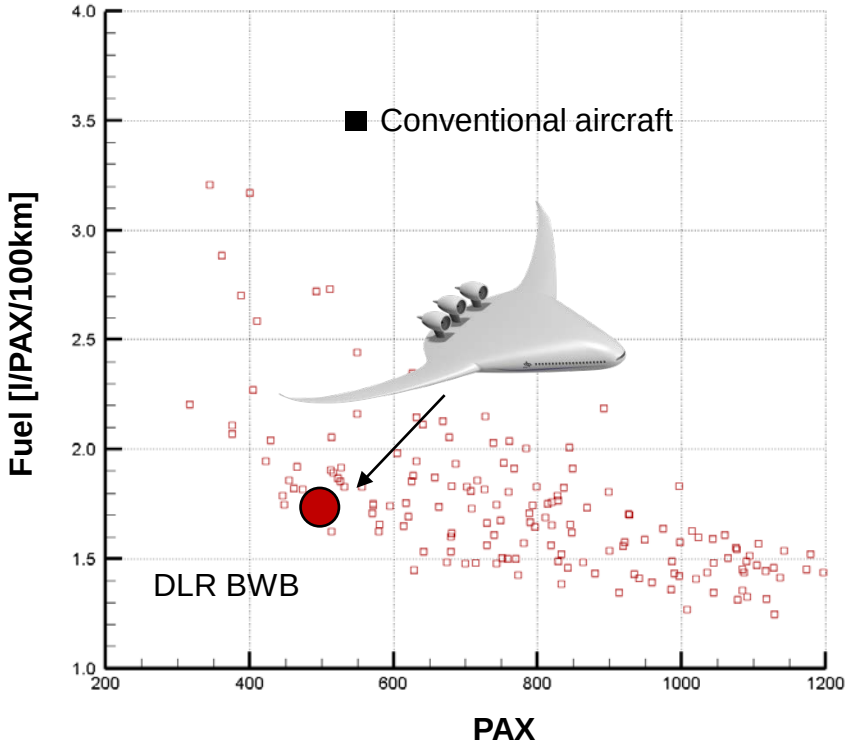


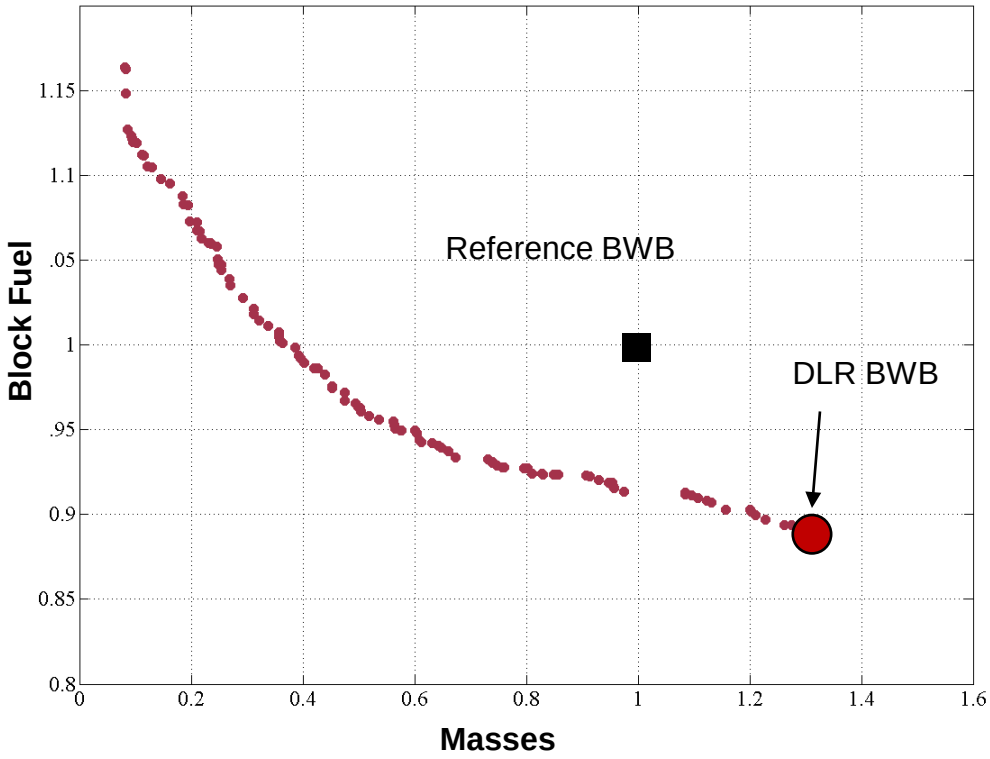
Source: DLR, Institute for Air Transportation Systems

DLR BWB

Potentials assessment

- Block fuel improvements respect to conventional configurations





Source: DLR, Institute for Air Transportation Systems

DLR BWB

Answers to global developments

- Provides mass transport capacity on growing long range distances (EU-Asia, EU South America, US-Asia, US-South America
- Provides reduced airspace and airport capacity demand per transport performance
- Provides less emissions and less noise per transport performance (g Nox/Pkm)
- High comfort cabin

Thank you for your interest!

Univ. Prof. Dr.-Ing. Volker Gollnick
E-Mail: volker.gollnick@dlr.de

M.Sc. Pier Davide Ciampa
E-Mail: pier-davide.ciampa@dlr.de

Address: German Aerospace Center (DLR)
Institute for Air Transportation Systems of DLR at TUHH
Blohmstraße 18
D-21079 Hamburg
Germany